[0075] When driven, the charge on the driving line **152**A capacitively couples to the intersecting sensing lines **152**B through the nodes **154** and the capacitive sensing circuit senses all of the sensing lines **152**B in parallel. Thereafter, the next driving line **152**A is driven, and the charge on the next driving line **152**A capacitively couples to the intersecting sensing lines **152**B through the nodes **154** and the capacitive sensing circuit senses all of the sensing lines **152**B in parallel. This happens sequential until all the lines **152**A have been driven. Once all the lines **152**A have been driven, the sequence starts over (continuously repeats). In most cases, the lines **152**A are sequentially driven from one side to the opposite side.

[0076] The capacitive sensing circuit typically includes one or more sensor ICs that measure the capacitance in each of the sensing lines **152**B and that reports its findings to a host controller. The sensor ICs may for example convert the analog capacitive signals to digital data and thereafter transmit the digital data over a serial bus to a host controller. Any number of sensor ICs may be used. For example, a sensor IC may be used for all lines, or multiple sensor ICs may be used for a single or group of lines. In most cases, the sensor ICs **110** report tracking signals, which are a function of both the position of the node **154** and the intensity of the capacitance at the node **154**.

[0077] The lines **152** are generally disposed on one or more optical transmissive members **156** formed from a clear material such as glass or plastic. By way of example, the lines **152** may be placed on opposing sides of the same member **156** or they may be placed on different members **156**. The lines **152** may be placed on the member **156** using any suitable patterning technique including for example, deposition, etching, printing and the like. Furthermore, the lines **152** can be made from any suitable transparent conductive material. By way of example, the lines may be formed from indium tin oxide (ITO). The driving lines **152**A are typically coupled to the voltage source through a flex circuit **158**A, and the sensing lines **152**B are typically coupled to the sensing circuit, and more particularly the sensor ICs through a flex circuit **158**B. The sensor ICs may be attached to a printed circuit board (PCB). Alternatively, the sensor ICs may be placed directly on the member **156** thereby eliminating the flex circuit **158**B.

[0078] The distribution of the lines **152** may be widely varied. For example, the lines **152** may be positioned almost anywhere in the plane of the touch screen **150**. The lines **152** may be positioned randomly or in a particular pattern about the touch screen **150**. With regards to the later, the position of the lines **152** may depend on the coordinate system used. For example, the lines **152** may be placed in rows and columns for Cartesian coordinates or concentrically and radially for polar coordinates. When using rows and columns, the rows and columns may be placed at various angles relative to one another. For example, they may be vertical, horizontal or diagonal.

[0079] Furthermore, the lines **152** may be formed from almost any shape whether rectilinear or curvilinear. The lines on each layer may be the same or different. For example, the lines may alternate between rectilinear and curvilinear. Further still, the shape of the opposing lines may have identical shapes or they may have different shapes. For example, the driving lines may have a first shape while the sensing lines may have a second shape that is different than the first shape. The geometry of the lines **152** (e.g., linewidths and spacing) may also be widely varied. The geometry of the lines within each layer may be identical or different, and further, the geometry of the lines for both layers may be identical or different. By way of example, the linewidths of the sensing lines **152**B to driving lines **152**A may have a ratio of about 2:1.

[0080] Moreover, any number of lines **152** may be used. It is generally believed that the number of lines is dependent on the desired resolution of the touch screen **150**. The number of lines within each layer may be identical or different. The number of lines is typically determined by the size of the touch screen as well as the desired pitch and linewidths of the lines **152**.

[0081] In the illustrated embodiment, the driving lines **152**A are positioned in rows and the sensing lines **152**B are positioned in columns that are perpendicular to the rows. The rows extend horizontally to the sides of the touch screen **150** and the columns extend vertically to the top and bottom of the touch screen **150**. Furthermore, the linewidths for the set of lines **152**A and **152**B are different and the pitch for set of lines **152**A and **152**B are equal to one another. In most cases, the linewidths of the sensing lines **152**B are larger than the linewidths of the driving lines **152**A. By way of example, the pitch of the driving and sensing lines **152** may be about 5 mm, the linewidths of the driving lines **152**A may be about 1.05 mm and the linewidths of the sensing lines **152**B may be about 2.10 mm. Moreover, the number of lines **152** in each layer is different. For example, there may be about 38 driving lines and about 50 sensing lines.

[0082] As mentioned above, the lines in order to form semi-transparent conductors on glass, film or plastic, may be patterned with an ITO material. This is generally accomplished by depositing an ITO layer over the substrate surface, and then by etching away portions of the ITO layer in order to form the lines. As should be appreciated, the areas with ITO tend to have lower transparency than the areas without ITO. This is generally less desirable for the user as the user can distinguish the lines from the spaces therebetween, i.e., the patterned ITO can become quite visible thereby producing a touch screen with undesirable optical properties. To further exacerbate this problem, the ITO material is typically applied in a manner that produces a relatively low resistance, and unfortunately low resistance ITO tends to be less transparent than high resistance ITO.

[0083] In order to prevent the aforementioned problem, the dead areas between the ITO may be filled with indexing matching materials. In another embodiment, rather than simply etching away all of the ITO, the dead areas (the uncovered spaces) may be subdivided into unconnected electrically floating ITO pads, i.e., the dead areas may be patterned with spatially separated pads. The pads are typically separated with a minimum trace width. Furthermore, the pads are typically made small to reduce their impact on the capacitive measurements. This technique attempts to minimize the appearance of the ITO by creating a uniform optical retarder. That is, by seeking to create a uniform sheet of ITO, it is believed that the panel will function closer to a uniform optical retarder and therefore non-uniformities in the visual appearance will be minimized. In yet another embodiment, a combination of index matching materials and unconnected floating pads may be used.